# MA$3025(4-1)$ **Logic and Discrete Mathematics** FALL 2008

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**Office Hours :** Mo., Tu., Wed., and Th. $10:00 - 10:50$ (or by appointment).

**Textbook :** *Discrete Mathematics and Its Applications*, 6th Edition, K.H. Rosen, WCB/McGraw-Hill 2007.

Prerequisite: MA2025, or equivalent exposure to elementary propositional and predicate logic and mathematical proof.

**Homework:** Regular homework assignments will be made but none will be collected.

**Make-up policy :** There will be absolutely no accepting of late or make-up assignments. If you know you will be missing school, you can take the quiz ahead of time, if you let me know two days before the quiz will be given. If you cannot attend the Exams, a makeup will be given only if you have informed me of your expected absence no later than 2 class periods preceding the test. For sudden illness and accidents, please see me upon your return to class.

**Grading:** 3 Exams (100 points each) The final grade is the average of the 3 exams; The tentative exam dates are: October 18th, November 15th and December 6th.

**Incompleteness:** An "incomplete" will be given only when a small portion of the work is not completed and for personal emergencies only, if the work has been completed satisfactory. The incomplete will not be given to avoid a low grade for the course.

**Course Description:** MA3025 is the second in a two-course sequence designed to provide a foundation in logic and elementary discrete mathematics. The course is useful for students from a number of disciplines, but has been specifically tailored for students of computer science. The emphases are twofold: the course begins with an

rapid review of "naive" propositional and first-order predicate logic, which is covered in depth in MA2025. Following this review, we extend the coverage of some topics introduced in MA2025 and introduce new topics that do not appear in the previous course. The study of the integers resumes with the extended Euclidean Algorithm, which leads to solutions of linear congruences, the Chinese Remainder Theorem. We then extend the introduction to counting begun in MA2025, to include the Binomial Theorem, combinatorial proof, generalized permutations and combinations, and the principle of inclusion-exclusion. The balance of the syllabus is on new topics. First is an introduction to recurrence relations. Coverage is limited to linear, constant-coefficient recurrence relations and the method of characteristic roots. After a brief digression to review the bare fundamentals of matrix arithmetic, including Boolean operations on $0, 1$-matrices, we introduce relations. Covered are the fundamental properties of relations, representation using matrices and digraphs, closures, and the special cases of equivalence and partial order relations. Finally, we study the basics of graphs and trees in graph theory.

| Week | Sections | Topics |
|------|----------|--------|
| 1: | $1.1 - 1.7$ | Review: Logic, Propositional Equivalence, Predicates, Quantifiers, Methods of Proof |
| 2: | $2.1 - 2.2$ | Review: Sets and Set Operations |
| 2: | $3.4 - 3.7$ | Euclidean Algorithm, Linear Congruences, Chinese Remainder Thm |
| 3: | $5.1 - 5.4$ | Binomial Theorem, Combinatorial Proof, Generalized |
| 4: | $5.5$ | Generalized Permutations and Combin |
| Exam 1 October 18th | | |
| 5: | $4.1 - 4.3$ | Weak Induction, Strong Induction, Recursively Defined Sets, Sequences, and Functions |
| 6: | $7.1, 7.2$ | Linear Constant-Coefficient Recurrence Relations |
| 6: | $7.5, 7.6$ | The Principle of Inclusion-Exclusion |
| 7: | $3.8, 8.1, 8.3,$ | Introduction to Matrices; Relations |
| 8: | $8.5$ | Equivalences and Partitions |
| Exam 2 November 15th | | |
| 9: | $9.1–9.4$ | Graphs: Definitions, Graph Models, Representation, Isomorphism |
| 10: | $9.5, 9.7$ | Graphs: Euler and Hamilton Paths, Planar Graphs |
| 11: | $9.8$ | Graph Coloring |
| Exam 3 December 6th | | |